Summary of the invention

The invention thus relates to an electric household appliance for preparation of food. In a known way, this appliance comprises an electric motor able to drive a rotary tool at a variable speed and a monitoring/control device comprising means to cause the motor to operate according to at least a first operating mode and a second operating mode.

This appliance also includes means to evaluate the load or the resistive torque applied to the motor, as well as means for automatically switching the operation of the appliance from the first operating mode to the second operating mode when said load passes below a first predetermined threshold, and in which, when the load passes from a value higher than the first threshold with a value lower than the first threshold, the operating speed of the appliance decreases on a long term basis.

In accordance with the invention, this appliance is characterized in that when the load passes from a value greater than the first threshold to a value lower than the first threshold, the operating speed of the appliance decreases on a long term basis to a non-zero value, and in that the monitoring/control device also has means to automatically switch the operation of the appliance from the second operating mode to the first operating mode when the load again passes above a second predetermined threshold, and in that when the load passes from a value lower than the second threshold to a value higher than the second threshold, the speed of operation of the appliance increases on a long term basis.

In other words, the invention consists in ensuring a monitoring of the load applied to the motor. This not only makes it possible to automatically reduce the speed of the latter when it is no longer necessary to exert a high torque, but also to again increase the speed as soon as the presence of food to be treated is detected.

In other words, the system is able to be placed automatically "in standby" (second operating mode), by automatically reducing the speed in the case of an operation of the tool when empty, while remaining ready to provide a higher speed (first operating mode) when that again becomes necessary. This management is done in a completely automatic way without the user having to carry out any action.

The speed of the motor, and thus its electric consumption, is thus optimized. Also, one avoids an inopportune generation of acoustic noises in the phases where the motor turns while the appliance is empty.

Due to the reduction of the speed of the motor to a non-zero value when the load drops below the first predetermined threshold, detection of an increase in the load on the tool above the second predetermined threshold is facilitated; in addition, this arrangement also permits indicating to the user that the appliance is in a standby state and not stopped.

Advantageously, when the load passes from a value higher than the first threshold to a value lower than the first threshold, the speed of operation of the appliance decreases by at least 5%; and when the load passes from a value lower than the second threshold to a value higher than the second threshold, the speed of operation of the appliance increases by at least 5%.

The first operating mode can be defined by a first reference speed and the second operating mode can be defined by a second reference speed.

The speed applied to the motor can be defined by an assigned speed, when the appliance comprises a speed sensor associated with a regulation device. The means for increasing or decreasing the speed can consist of a modification of the assigned speed of the motor.

The speed applied to the motor can also depend on the characteristic of the torque/speed curve of the motor, when the motor speed is not regulated. In this last case, the

the threshold predetermined for this placing in standby, for a predetermined length of time. In other words, the speed can be further reduced, or even eliminated, when the standby state persists, signifying that the operations on food are ended.

In practice, the means to detect the load applied to the motor can be very varied. The torque can be thus measured by a force sensor provided for this purpose, or even by measurements of electric parameters specific to the motor, such as the current consumed by the motor or the voltage between its terminals. It is also possible to detect a load variation by a measurement of the difference between an assigned speed and a measured speed, or even by a measurement of the acoustic noise.

The load fluctuations are also a means of knowing that the tool is working. It is possible to take account of the load fluctuations in the estimate of the torque. Thus the estimated torque can be increased if the load fluctuates. In an equivalent way, a fluctuation of load can be taken into account by an increase of the torque threshold.

The speed of the motor is reduced to a non-zero value when the load passes below the first predetermined threshold. This provision makes it possible to facilitate the detection of an increase in load on the tool above the second predetermined threshold. This provision also makes it possible to signal to the user that the appliance is in the standby state. Alternatively, if the motor no longer turns when the appliance is in the standby state, an indicating device could be considered, in particular an indicator light device.

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CLAIMS

1/ Electric household appliance for preparation of food (1), having an electric motor (3) able to drive a rotary tool (10) at a variable speed, a monitoring/control device (5) comprising means to cause the motor to operate according to at least a first operating mode and a second operating mode, means to evaluate the load or the resistive torque (C_1, C_2, C_3) applied to the motor, and means for automatically switching the operation of the appliance from the first operating mode to the second operating mode when said load passes below a first predetermined threshold (S_B), and in which, when the load passes from a value higher than the first threshold (S_B) to a value lower than the first threshold (S_B), the speed of operation of the appliance decreases on a long term basis, characterized in that when the load passes from a value greater than the first threshold (S_B) to a value lower than the first threshold (S_B), the operating speed of the appliance decreases on a long term basis to a non-zero value, and in that the monitoring/control device (5) also comprises means to automatically switch the operation of the appliance from the second operating mode to the first operating mode when said load again passes above a second predetermined threshold (S_H), and in that when the load passes from a value lower than the second threshold (S_H)to a value higher than the second threshold (S_H), the speed of operation of the appliance increases on a long term basis.

2/ Appliance according to claim 1, characterized in that when the load passes from a value higher than the first threshold

(S_B) to a value lower than the first threshold (S_B), the speed of operation of the appliance decreases by at least 5%.

3/ Appliance according to claim 1 or according to claim 2, characterized in that when the load passes from a value lower than the second threshold (S_H) to a value higher than the second threshold (S_H), the speed of operation of the appliance increases by at least 5%.

4/ Appliance according to one of claims 1 to 3, characterized in that the predetermined load thresholds for the automatic reduction (S_B) and/or increase (S_H) of the speed of the motor, depend on the initial speed value.

5/ Appliance according to one of claims 1 to 4, characterized in that the predetermined thresholds (S_B, S_H) are identical for the reduction and automatic increase of the speed.

6/Appliance according to one of claims 1 to 5, characterized in that it has means to additionally decrease the speed when the load (C_3) remains below the predetermined threshold for the reduction of the speed for a predetermined length of time.

7/Appliance according to one of claims 1 to 6, characterized in that the assigned speed after reduction is a function of the measured value of the load.

8/Appliance according to one of claims 1 to 7, characterized in that the means to detect the load applied to the motor include means (15) to measure the electrical current consumed by the motor, or the voltage at the terminals of the motor (3).

9/Appliance according to one of claims 1 to 8, characterized in that the means to detect the load applicable to the motor

include means for measurement of the acoustic noise generated by the appliance.

10/Appliance according to one of claims 1 to 10, characterized in that the speed of the motor is reduced by at least 15% when the load passes below the first predetermined threshold (S_B).

11/Appliance according to one of claims 1 to 11, characterized in that the speed of the motor is reduced by at least 30% when the load passes below the first predetermined threshold (S_B).

12/Appliance according to one of the claims 1 to 12, characterized in that the electric motor (3) is a universal motor.